NASA GSFC Advanced Architectures and Automation (Code 588)

SPLAT SYSTEM REQUIREMENTS SPECIFICATION

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System Requirements Specification for SPLAT

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1 Introduction

1.1 Purpose

The purpose of this document is to describe the requirements for the Solid State Recorder (SSR) Playback Automation Tool (SPLAT), formerly Goal Oriented Commanding (GOC), being developed at the NASA Goddard Space Flight Center Advanced Automation and Architectures Branch (Code 588). The document describes the full functionality for the SPLAT tool and will be used to drive the design and implementation of the system.

1.2 Scope

The focus of this document is to describe the requirements for the proposed system through Use Case diagrams. The requirements presented in this document were derived from the following:

1. Meeting notes from the project kickoff meeting with Bill Muscovich. January 18, 2002.
2. Discussions with Bill Muscovich regarding special event planning
3. Notes taken during observation of SSR buffer dump scheduling for the Aqua Ground Network test and Terra inclination adjustment of 2/6/2002. January 24 and January 30, 2002.

1.3 Definition, Acronyms, and Abbreviations

Acronyms and abbreviations that are used throughout this document and a Glossary of selected terms are included in Appendix A.

1.4 Project Phasing

The development of the SPLAT project has being divided into several iterations. Each iteration builds upon the functionality provided in earlier versions. The iterations for the SPLAT project are as follows:

?? ***Build I*** **–** The initial build of the SPLAT tool. The user will be responsible for report retrieval from MMS. Dump window determination and synchronization point determination will be manual and performed by the user as well while report parsing and schedule generation will be automated.

?? ***Build II*** – The second build of the SPLAT tool will contain all the functionality in the first build with the following change. The tool will automatically determine both the synchronization point and the initial dump windows.

Refer to Section 2.4 for a description of the Use Cases corresponding to the different builds.

1.5 Overview

The remainder of this document consists of:

Section 2: System Description – provides a general description of the current process of scheduling Terra SSR buffer playbacks for special events/difficult scheduling periods and the system being developed to simplify the procedure for generating SSR Buffer dumps for these events. This section also presents the Use Case model from which functional requirements will be derived. The section finishes with a discussion of assumptions, constraints, and dependencies.

Section 3: System Requirements – presents the functional requirements for the system in the form of Use Case reports and includes a subsection containing non-functional requirements not covered by the Use Cases.

2 System Description

2.1 General System Overview

The SPLAT tool will partially automate the task of generating buffer dump schedules for the Terra SSR in response to special, non-standard events and difficult planning periods that preclude standard scheduling of buffer playbacks via the Mission Management System (MMS). Buffer dump scheduling for these events is currently a time consuming activity performed by a single member of the Flight Operations Team (FOT) using manual procedures supported by Microsoft Excel spreadsheets.

2.2 Operations Overview – Current System

Normal planning for SSR buffer dumps is part of the overall planning and scheduling process for Terra and occurs within MMS. However, special events (reduced TDRS time due to Space Shuttle Missions and the recent Ground Network Tests for Aqua) and difficult planning periods (special processing requested by Instrument Engineers) occur which preclude the use of MMS procedures to schedule SSR buffer dumps. For such periods, a manual method of scheduling the SSR buffer dumps is required.

The process of scheduling for difficult planning periods or special events begins with the identification of a difficult scheduling period. A member of an Instrument Operations Team (IOT) or a scheduler for the Terra spacecraft, while performing their normal duties, will identify a period of time for which they believe the MMS procedures are not sufficient for developing an SSR buffer dump schedule.

After such a period is identified, the Spacecraft Engineer responsible for managing the SSR is notified of the event. The Spacecraft Engineer then performs an analysis of the event to determine whether or not special event planning is required. If so, the Spacecraft Engineer begins the process of creating a buffer dump schedule for the planning period. If not, Spacecraft Engineer notifies the reporting individual that the MMS procedures will be able to create a valid dump schedule for the SSR.

If the Spacecraft Engineer determines that a special schedule is required, approximately 1 week prior to the special event, the process of creating the SSR dump schedule begins. The first step in generating the SSR buffer dump schedule for the special event is gathering the appropriate reports. In order to gather the needed reports, the Spacecraft Engineer logs into a workstation connected to MMS, and starts an MMS session. A new time line is created in MMS and the Spacecraft Engineer displays the current Terra operations schedule for review. After examining the time line data to ensure the correctness of the TDRS contacts and SSR buffer activities, the Spacecraft Engineer executes a series of utility programs to extract the reports required to schedule the special event from the MMS database. These utility programs extract report data for a user specified time period from the MMS database into flat text files. Data is extracted for

TDRS Contact periods and SSR Buffer States. Once the reports are extracted from MMS, the Spacecraft Engineer then changes directory to the orbital events directory in the MMS distribution tree and makes an electronic copy of the 1-week or 7-week AM1 Orbital Events file. Note that the file selected is dependent on how far in the future the Spacecraft Engineer is planning. Additionally note that if the Spacecraft Engineer is planning playbacks that require ground contacts (X-band), an electronic copy of the Ground Network (GN) report is obtained from the FOT.

Once electronic copies of the required reports have been generated, the Spacecraft Engineer exits MMS and begins the process of extracting the events required for SSR buffer dump planning from the individual reports. This process involves importing the individual reports into Microsoft Excel, removing data outside the planning horizon and events not required for SSR buffer dump planning. Each report is parsed individually in a different Excel window, and the resultant data is merged to form a single Excel spreadsheet containing contact periods (S, K, and X-band contacts) and MODIS and MISR day/night events.

After parsing the reports, the Spacecraft Engineer examines the contact information and day/night events data in the Excel spreadsheet as well as the entries in the SSR Buffer States Report to find a contact (the latest contact before the start of the planning horizon) long enough to completely empty the SSR buffers. This point is identified as the synchronization contact and represents the first contact scheduled for the special event.

After locating the synchronization contact, the Spacecraft Engineer determines the appropriate dump windows for each individual contact in the planning period. The Spacecraft Engineer determines the dump windows by examining the parsed contact information. As dump windows are determined, they are entered individually into the Excel spreadsheet containing the contact information and day/night events.

Once the synchronization point and dump windows have been determined, SSR buffer dump scheduling can begin. Planning starts at the synchronization contact and continues for each dump window in the planning horizon. As each contact is scheduled, the computed playback times (start and stop times) and buffer usages are added to the spreadsheet containing the contact information and day/night events. The process of scheduling for an individual contact requires that the Spacecraft Engineer enter the current SSR buffer usages and day/night mode changes into the Excel spreadsheet designed to calculate buffer usages and playback durations based on mode changes, contact windows, and dump windows. The Spacecraft Engineer can accept the values generated by the spreadsheet and enter them into the final report, or tweak the buffer dump percentages and dump windows to fit the needs of the event. This processing continues until buffer dumps for all contacts in the planning period have been generated.

Once all contacts in the planning window have been processed and the playback times and buffer usages entered into the Excel spreadsheet, the Spacecraft Engineer examines the schedule to ensure its correctness. The Spacecraft Engineer then saves the schedule to a file, and prints it for delivery to the Online Personnel.

The online controller reviews and approves the schedule and the online engineer uplinks the schedule to the spacecraft for execution.

2.2.1 Process Improvement Opportunities

Several opportunities exist for improving the SSR special event playback generation process. These include automating the ingestion of required reports, eliminating the need to manually transfer scheduling data among printed documents and spreadsheets, and automated generation of schedules. This automation will make it feasible for any Spacecraft Engineer to handle special event scheduling. Varying degrees of integration with the MMS system are possible, ranging from manual extraction of required reports from MMS by the operator to extraction of planning and scheduling inputs from MMS via utilities.

The following improvements to the process are proposed:

1. Report Parsing – SPLAT will automate the manually intensive task of parsing out the needed events from the Input Reports. This is a time consuming process prone to errors and automated parsing will provide for a quicker turn around and more reliable results.

2. Schedule Generation – SPLAT will automate the process of generating the playback schedules relieving the need for the operator to manually schedule each individual contact period in a scheduling period.

SPLAT will allow any Spacecraft Engineer or member of the FOT to generate SSR Buffer Playback Schedules without requiring intimate knowledge of the SSR or Terra instruments.

2.2.2 Proposed Operations

The current special event planning will continue up to the point of report retrieval. Once notified of a special event or difficult planning period, the SSR Scheduler will return to their personal computer and start SPLAT.

Within SPLAT, the SSR Scheduler enters the start and stop times for the planning window, an ASTER modeling percentage if ASTER data is not available, selects whether or not ground contacts are needed. After the user confirms the scheduling options, the system either retrieves the needed reports from a local directory. If ASTER data is available (ATC Load Report) for the planning horizon and the user has chosen automatic ASTER modeling, the operator extracts the ATC Load Report from MMS as well.

Once the reports have been retrieved, SPLAT parses the individual reports, extracting contact periods, day/night events, SSR Buffer states, and possibly ASTER buffer usages, if applicable. At this point, SPLAT uses the extracted contact information and the extracted SSR buffer states to determine candidate dump windows for each contact. The system will initially select dump windows only at Acquisition of Signal (AOS). The system then selects the synchronization point at which scheduling will begin. When all reports have been parsed and candidate dump windows and a synchronization point have been determined, SPLAT displays the contact periods and dump windows for user review.

The SSR Scheduler then reviews the contact and dump window information displayed by the system and if desired edits the dump windows modifying, adding or deleting dump window entries. After the dump windows have been edited, the SSR scheduler reviews and modifies, as needed, the synchronization point determined by SPLAT. The SSR Scheduler then instructs SPLAT to create an SSR buffer dump schedule. SPLAT creates a schedule containing entries for each of the dump windows specified by the user based on buffer usages, day/night events, and dump window durations, and maximum buffer dump percentages.

Once created, the SSR dump schedule is displayed by SPLAT for review by the SSR Scheduler. At this point the SSR Scheduler chooses to save, print, or cancel the currently displayed schedule. If the SSR Scheduler determines that the schedule is acceptable, it is saved to a file, a hardcopy of the schedule is printed, and manually delivered to the Online Personnel for review, approval, and execution.

2.3 Assumptions, Constraints, and Dependencies

SPLAT must operate within the Terra EOC mission environment. The system requirements assume that the Terra FOT includes personnel whose normal duties encompass the roles defined by the various system Actors.

SPLAT expects specific data inputs from MMS and the GN Report. The expected inputs and their contents are identified in Section 3.2.

2.4 Use Case Model Survey

Table 2-1 provides a list of the use cases presented in the Use Case Reports and the build(s) to which they pertain.

Table 2-1: Use Case Model Descriptions

Use Case Name	Description	Build(s)
Determine Dump Windows	This use describes the process of determining the initial dump windows for each contact in the scheduling window.	Build II

Determine Sync Point	This use case describes the steps required for selecting the synchronization point.	Build II
Edit Dump Windows	This use case documents the process of editing the dump windows.	Build I
Edit Modeling Parameters	This use case describes the steps performed by the user to modify the parameters used in schedule creation.	Build I
Edit Sync Point Parameters	This use case describes the steps a user must follow to edit the synchronization point values for buffer dump scheduling.	Build I
Generate SSR Buffer Dump Schedule	This use case describes the process the user must follow to create an SSR buffer dump schedule from the extracted report entries.	Build I
Print Dump Schedule	This use case describes the steps a user must follow to print an SSR buffer dump schedule.	Build I
Process Input Reports	This use case describes the parsing of the input reports. It is kicked off by the user entering a start and stop time for special event.	Build I
Retrieve Reports	This use case describes the operations needed to retrieve the input reports needed by the system.	Build I & III
Save Dump Schedule	This use case describes the steps the user must follow to save a generated SSR buffer dump schedule to a text file.	Build I
Select ASTER Modeling Mode	This use case describes the steps a user must follow to select the ASTER modeling mode.	Build I
Select Print/Display Options	This use case describes the steps performed by the user to select available report fields to display and print in hardcopy reports.	Build I
Specify Scheduling Options	This use case describes the steps a user must perform to specify the required data required to extract the necessary events from the input reports and ensure that the correct reports are used.	Build I

2.4.1 Actors

Table 2-2 describes the users and external systems (or actors) that interface with the system.

Table 2-2: List of Actors

Actor	Actor Description
MMS	This actor represents the Mission Management Software (MMS). MMS is an external system that provides the reports needed to schedule SSR Buffer dumps for special events. The following reports are provided by/extracted from the MMS: the TDRS Contact report, AM1 Orbital Events report, SSR Buffer States report, and the ATC Load Report.
SSR Scheduler	The SSR Scheduler is the main actor in the system and controls the operation of the tool. The SSR Scheduler reviews, monitors and supports command activity, spacecraft activity log, spacecraft recorder management, and clock maintenance. The SSR Schedule may be a Spacecraft Engineer, Flight Engineer, or other member of the FOT.

2.4.2 Use Case Diagrams

Figure 2-1 depicts a detailed diagram of the proposed system. The primary actors are described in detail in section 2.4.1 and the use cases are described briefly in section 2.4, with more detail provided in Section 3.1.

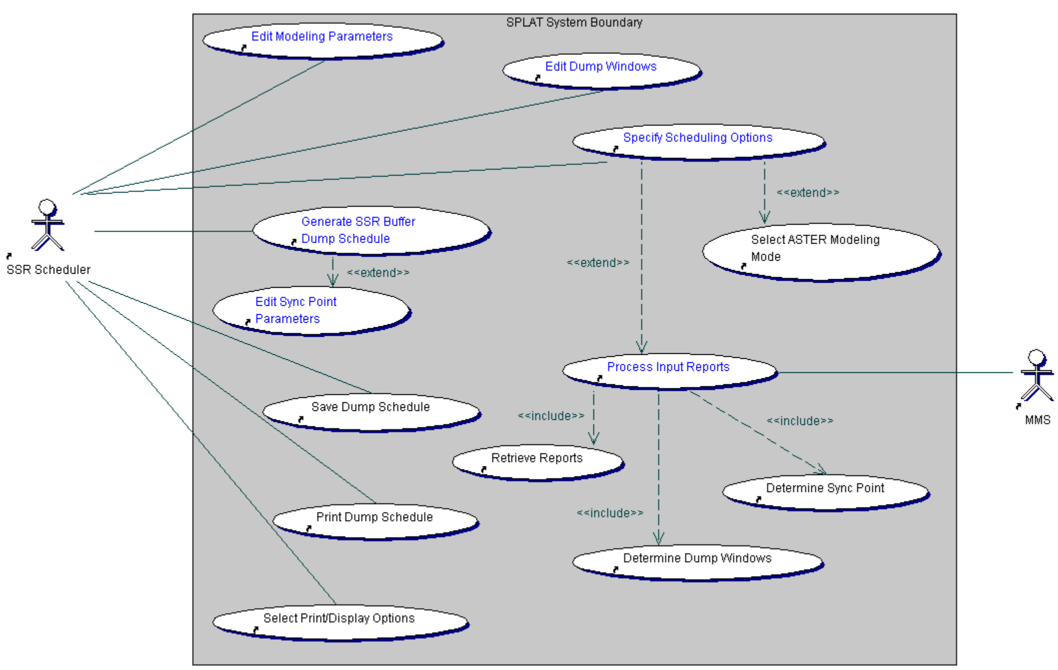

Figure 2-1: Use Case Diagram for SPLAT

3 System Requirements

Section 3.1 presents the Use Case scenarios for the Use Cases identified in Section 2.4. These scenarios specify the functional requirements for the system. Section 3.2 documents additional requirements of a non-functional nature such as performance, reliability, interfaces, environment, etc.

3.1 Use Case Reports

3.1.1 Use Case: Determine Dump Windows

Name:	**Determine Dump Windows**
Description:	This Use Case documents the process of determining the initial dump windows for each contact in the planning horizon.
Pre-Conditions:	Use Case: Determine Sync Point.
Post Conditions:	None
Primary Actor:	None
Risk:	None

Normal Flow

	Actor Actions		System Responses
		1	The system examines the extracted contact information and assigns dump windows at the start of each contact (AOS) for each of the contact periods in the planning window.
		2	The system displays the dump windows and contact periods for user review.

Alternate Flow

	Actor Actions		System Responses
	None		

3.1.2 Use Case: Determine Sync Point

Name:	**Determine Sync Point**
Description:	This Use Case describes the steps required for selecting the synchronization point.
Pre-Conditions:	All required reports must be retrieved and parsed.
Post Conditions:	None
Primary Actor:	None
Risk:	None

Normal Flow

	Actor Actions		**System Responses**
		1	The system examines the extracted contact information and the buffer states entries extracted from the SSR Buffer states report to locate the latest contact before the start of the scheduling period long enough to completely empty the SSR buffers.
		2	The system saves the synchronization point values.

Alternate Flow

	Actor Actions		**System Responses**
	None		

3.1.3 Use Case: Edit Dump Windows

Name:	**Edit Dump Windows**
Description:	This Use Case documents the process of editing the dump windows.
Pre-Conditions:	Use Case: Process Input Reports.
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		**System Responses**
1	The user selects the edit dump windows option.	2	The system displays the current dump windows.
3	The user adds, deletes or modifies dump		

	window entries one at a time. Each entry contains the dump number, dump start and stop times, number of dumps in the contact and buffer playback amounts for the ASTER, MISR, and MODIS buffers.		
4	The user confirms the modifications.	5	The system saves the dump windows.

Alternate Flow

	Actor Actions		System Responses
	None		

3.1.4 Use Case: Edit Modeling Parameters

Name:	**Edit Modeling Parameters**
Description:	This Use Case describes the steps performed by the user to modify the parameters used in schedule creation.
Pre-Conditions:	Permission to edit the modeling parameters.
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		System Responses
1	The user selects the edit modeling parameters option.	2	The system displays the frequently modified modeling parameters for review/modification.
3	The user modifies modeling parameters. Each entry consists of a parameter name and value pair.		
4	The user confirms the modifications	5	The system saves the parameters.

Alternate Flow

	Actor Actions		System Responses
2a	The user selects the advanced option.	3a	The system displays the infrequently modified modeling parameters for review/modification..
4a	The user modifies the modeling parameters.		
5a	The user confirms the modifications	5a	The system saves the parameters.

3.1.5 Use Case: Generate SSR Buffer Dump Schedule

Name:	**Generate SSR Buffer Dump Schedule**
Description:	This Use Case describes the process the user must follow to create an SSR buffer dump schedule from the extracted report entries.
Pre-Conditions:	Use Case: Select Scheduling Options Use Case: Process Input Reports.
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		**System Responses**
1	The user reviews the contact information displayed by the.		
2	The user selects the edit sync point options (See Edit Sync Point Parameters Use Case).		
3	The edits selects the Dump windows (see Use Case Edit Dump Windows).		
4	The user selects the generate option.	5	The system iterates through each dump window in the dump windows file and creates SSR buffer dumps for each dump window based on MISR, MODIS, and ASTER usage as well as contact duration, and day/night events.
		6	The system displays the SSR buffer dump schedule for user review and acceptance.
7	The user saves the current schedule. (See Use Case Save Dump Schedule)		

Alternate Flow

	Actor Actions		**System Responses**
7a	The user prints the current schedule. (See Use Case Print Dump Schedule).		
7b	The user selects delete and the current schedule is removed.		

3.1.6 Use Case: Print Dump Schedule

Name:	Print Dump Schedule
Description:	This Use Case describes the steps a user must follow to print a playback schedule.
Pre-Conditions:	Use Case: Generate Playback Schedule.
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		System Responses
1	The user selects the print option.	2	The system displays printer options for user selection.
3	The user selects the required printer options.	4	The system spools the currently visible dump schedule to the selected printer.

Alternate Flow

	Actor Actions		System Responses
	None		

3.1.7 Use Case: Process Input Reports

Name:	Process Input Reports
Description:	This Use Case describes the processing of the required input reports. It is initiated by the user entering a start and stop time for planning window.
Pre-Conditions:	Use Case: Specify Scheduling Options.
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		System Responses
		1	The system extracts contact information and day/night events from the retrieved reports.
		2	The system combines the events

			extracted from the reports, sorts the events by date and time and displays the information to the user for review.

Alternate Flow

	Actor Actions		System Responses
		1a	If the user selected automatic ASTER modeling mode, the system parses the ATC Load Report, extracting ASTER imaging events.
		1b	If the user selected ground contacts, the system parses the Ground Network (GN) Report, extracting X-band contact periods.

3.1.8 Use Case: Retrieve Reports

Name:	**Retrieve Reports**
Description:	This Use Case describes the operations required to retrieve the input reports needed by the system.
Pre-Conditions:	Use Case: Specify Scheduling Options All data needed to generate MMS reports must be available in MMS database.
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		System Responses
		1a	If the report retrieval mode is set to local, the system prompts the user for a local directory from which the required reports are to be retrieved.
2a	The user enters the local directory for the reports.		
3a	The user confirms the location of the reports.	4a	The system retrieves the reports.

Alternate Flow

	Actor Actions		System Responses
		1	If the report retrieval mode is set to MMS, the system sends a request to MMS for the required reports..
		2	If Ground Contacts are selected, the system stores the GN report in a common directory for processing.

3.1.9 Use Case: Save Dump Schedule

Name:	**Save Dump Schedule**
Description:	This Use Case describes the steps the user must follow to save a generated SSR Playback schedule to a text file.
Pre-Conditions:	Use Case: Generate SSR Buffer Dump Schedule.
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		System Responses
1	The user selects the save dump schedule option.	2	The system prompts the user for a name and location for the saved schedule.
3	The user specifies a name and location for the schedule and confirms the save.	4	The system saves the currently active dump schedule in the specified data file and location.

Alternate Flow

	Actor Actions		System Responses
	None		

3.1.10 Use Case: Select ASTER Modeling Mode

Use Case:	**Select ASTER Modeling Mode**
Description:	This Use Case describes the steps a user must follow when selecting the ASTER buffer modeling mode and percentage.

Pre-Conditions:	None
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		**System Responses**
1	The user selects the fixed ASTER modeling mode.	2	The system enables the ASTER modeling percentage option.
3	The user enters a specific modeling percentage.		
3	The user confirms the selection.		

Alternate Flow

	Actor Actions		**System Responses**
1a	The user selects the automatic ASTER modeling option.		

3.1.11 Use Case: Select Print/Display Options

Use Case:	**Select Print/Display Options**
Description:	This Use Case describes the steps performed by the user to select available report fields to display and print in hardcopy reports.
Pre-Conditions:	None
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		**System Responses**
1	The user selects the option to edit the print/display options.	2	The system displays fields available for display and printing
3	The user selects the fields to be displayed and printed to hardcopy reports.		

4	The user confirms the selection.		

Alternate Flow

	Actor Actions		System Responses
	None		

3.1.12 Use Case: Specify Scheduling Options

Name:	**Specify Scheduling Options**
Description:	This Use Case describes the steps performed by the user to specify information needed to extract the necessary events from the input reports and ensure that the correct reports are used.
Pre-Conditions:	Use Case: Edit Modeling Parameters.
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		System Responses
1	The user chooses to modify the scheduling options.	2	The system displays the scheduling options.
3	The use enters a start and stop time and date for the special event.		
2	The user selects the appropriate time delta to apply to the beginning and end of the special event window.		
3	The user selects the ASTER calculation method. (Fixed or Automatic. See Use Case: Select ASTER Modeling Mode).		
4	The user disables ground contact scheduling.		
5	The user selects the report retrieval mode (local or MMS)		
6	The user selects the process reports option.		

Alternate Flow

	Actor Actions		System Responses
4a	The user selects the ground contacts scheduling option.	5a	The system prompts the user for specification of the Ground Network (GN) Report file name and location.

6a	The user enters a name and location for the GN Report.	7a	The system copies the GN Report to a common directory for processing.
8a	The user confirms the scheduling options.		

3.1.13 Use Case: Edit Sync Point Parameters

Name:	**Edit Sync Point Parameters**
Description:	This Use Case describes the steps a user must follow to modify the synchronization point for buffer dump scheduling.
Pre-Conditions:	None
Post Conditions:	None
Primary Actor:	SSR Scheduler
Risk:	None

Normal Flow

	Actor Actions		**System Responses**
1	The user selects the edit sync point option.	2	The system displays the current sync point values.
3	The user reviews and/or selects a synchronization point from the displayed options.		
4	The user confirms the entered values.		
		5	The system stores the synchronization point parameters.

Alternate Flow

	Actor Actions		**System Responses**
	None		

3.2 Supplemental Requirements

This section documents non-functional requirements in addition to those functional requirements that are not captured by the use cases.

3.2.1 Functional Requirements

The scheduling algorithms shall allocate playback time for buffers from smallest to largest. The smallest buffer will be given higher priority with respect to playback time allocation. Once the smallest buffer has been scheduled, the next smallest buffer is scheduled in the remaining time, and so on until either the dump window time has been exhausted or all buffers are emptied.

The system shall maintain the following user modifiable modeling parameters:

- ASTER Fixed Mode Modeling Rate
- ASTER Automated Mode Imaging Rates for:
  - VNIR/SWIR/TIR Observation Mode in bits/sec
  - TIR Observation Mode in bits/sec
  - SWIR/TIR Observation Mode in bits/sec
- ASTER Buffer Capacity in Super Sets
- Bits per Super Set Conversion Rate
- MISR Buffer Capacity in Super Sets
- MISR Instrument Day Imaging Rate in bits/sec
- MISR Instrument Night Imaging Rate in bits/sec
- MISR start offset from NADIR (mm:ss)
- MISR end offset from NADIR (mm:ss)
- MODIS Buffer Capacity in Super Sets
- MODIS Instrument Day Imaging Rate in bits/sec
- MODIS Instrument Night Imaging Rate in bits/sec
- MODIS start offset from NADIR (mm:ss)
- MODIS end offset from NADIR (mm:ss)
- TDRS Contact Playback Rate in bits/sec
- Ground Contact (x-band) Playback Rate in bits/sec

The following information must be displayed for all synchronization points in a tabular form:

- Time
- MODIS buffer usage
- MODIS plan time
- MISR buffer usage
- MISR plan time
- ASTER buffer usage
- ASTER plan time

All displays of instrument information shall be ordered as follows:

- MODIS, MISR, ASTER

Scheduled playback start time shall be 1 minute after Contact Start Time when K-band Service Start Time is equal to S-band Service Start Time.

A configurable delta (4 hours initially) shall be added to the start and end of the planning window before report extraction.

Time shall be displayed with a resolution of seconds.

3.2.2 Usability Requirements

The system shall be designed to minimize the number of mouse clicks required to perform any operation.

Users shall be able to do all operations via keyboard (i.e. "hot" keys) and mouse.

3.2.3 Reliability Requirements

All scheduled times and durations generated by the system shall be accurate to within +/- 1 second.

3.2.4 Performance Requirements

Average time to retrieve reports, parse data and generate the contact display shall be less than 3 minutes.

Average time to generate a special event schedule shall be less than 2 minutes.

3.2.5 Supportability Requirements

The system shall support installation of software updates without impacting mission operations.

3.2.6 Documentation and Help System Requirements

Users shall have access to on-line help for SSR buffer dump scheduling via a pull-down menu from the main application window.

3.2.7 Purchased Components

No requirements pertaining to purchased components have been identified.

3.2.8 Interfaces

User Interfaces

The system shall provide a GUI that will allow system access from a desktop PC.

The main system GUI shall contain a tabular display window capable of displaying a list of color-coded contacts, mode changes, playback events, and buffer usages.

Hardware Interfaces

No requirements pertaining to hardware interfaces have been identified.

Software Interfaces

N/A

Communications Interfaces

The system shall connect to, and be accessible from, the EOC LAN.

The system shall receive the following data directly from a common directory:

?? **ATC Load Report**
The ATC Load Report defines every Absolute Time Command (ATC) and every Relative Time Command Sequence (RTCS) that will be uplinked to the spacecraft. The content of interest to the system is the list of ASTER specific RTCSs.

?? **TDRS Contact Report**
The TDRS Contact Report details every TDRS contact during the planning period. The system will use it to identify the S-Band contact windows and K-Band contact windows.

?? **Downlink Report (SSR Buffer States Report, Buffer Predicts)**
The Downlink Report contains SSR Buffer % full predicts and planned playback duration keyed to TDRS K-Band contacts in the TDRS Contact Report.

The system shall read the following data from a common directory:

?? **GN Report**
The GN Report contains ground network contact periods for Ground stations in Alaska and Svalbard, Norway.

3.2.9 Legal, Copyright, and Other Notices

Developed software and documentation shall comply with NASA/GSFC standards for labeling.

3.2.10 Applicable Standards

Applicable standards will be identified during the requirements refinement.

4 Supporting Information

Appendix A: GLOSSARY

Acronym / Abbreviation	Term	Definition
AOS	Acquisition Of Signal	The time at which the signal for the TDRS or Ground contact is acquired.
ASTER	Advanced Spaceborne Thermal Emission and Reflection	Instrument on-board TERRA owned and operated by the Japanese space agency.
	Aqua	The second EOS spacecraft. Formerly known as EOS PM. The focus for the Aqua satellite is the multidisciplinary study of the Earth's interrelated processes (atmosphere, oceans, and land-surface) and their relationship to Earth system changes.
	Aura	The third EOS spacecraft. Formerly known, as EOS Chem. Aura is a NASA mission to study the Earth's ozone, air quality and climate. This mission is designed exclusively to conduct research on the composition, chemistry and dynamics of the Earth's upper and lower atmosphere employing multiple instruments on a single satellite.
	actors	Actors are classes that define roles that objects external to a system may play. They are used in Use Cases to model users outside of a system that interact directly with the system. They can be humans or other systems.
EOC	EOS Operating Center	This is the center from which the Terra and, in the future Aqua and Aura, satellite(s) are operated from.
EOS	Earth Observing System	The overall system that contains the currently operating Terra and future Aqua and Aura satellites.
GN	Ground Network	The network of Ground stations (Alaska and Norway) which provide ground contacts for data downlink (X-Band)

Acronym / Abbreviation	Term	Definition
GSFC	Goddard Space Flight Center	
MISR	Multi-angle Imaging Spectro-Radiometer	An instrument on the Terra spacecraft.
MMS	Mission Management System	Unique to EOS, this system is the primary mission planning system for Terra. Among other products, it creates the TDRS Contact Report, and includes basic models for generating command loads.
MODIS	Moderate Resolution Imaging Spectrometer	An instrument on the Terra spacecraft.
NASA	National Aeronautics and Space Administration	
SPLAT	SSR Playback Automation Tool	The tool developed as part of this effort to assist in the development of Terra SSR Playback schedules during special events.
SSR	Solid State Recorder	This is Terra's on-board storage device. It operates using buffers wherein data from each instrument (4 buffers total) and housekeeping data are stored for later downlink to a ground station.
	SSR Playback	An SSR Playback is the downlink of stored instrument and spacecraft housekeeping data. This can also be referred to as an SSR Dump.
SWIR	Short Wave Infrared	A subsystem of the ASTER instrument.
	Terra	The first EOS spacecraft. Formerly known as AM1. It provides global data on the state of the atmosphere, land, and oceans, as well as their interactions with solar radiation and with one another.
TDRS(S)	Tracking and Data Relay Satellite (System)	This is a geo-synchronous satellite system used by NASA for satellite communications. It functions using a "bent-pipe" through White Sands, NM through the NASA Communications SYSTEM (NASCOM) at NASA GSFC. The Terra Spacecraft uses the K-Band antennas for downlink of SSR data and the S-Band antennas for commanding.

Acronym / Abbreviation	Term	Definition
TIR	Thermal Infrared	A subsystem of the ASTER instrument
	use case model	A use case model is a set of use case diagrams that describe a system's functionality.
	use case diagram	Use case diagrams depict the user view of a system. They describe the functionality provided by a system or class to external actors.
VNIR	Visible and Near Infrared	A subsystem of the ASTER instrument.